

## CRANE AND WINTER FLIES (DIPTERA: LIMONIIDAE, PEDICIIDAE, TRICHOCERIDAE) ASSOCIATED WITH FUNGI IN LITHUANIA

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**Abstract.** The list of Lithuanian crane flies and winter flies, whose larvae were found developing in fungi, is given. The list of fungi, in which larvae of crane and winter flies develop, is compiled in Lithuania for the first time. For the first time were larvae of *Metalimnobia bifasciata* (Schrank, 1781) reared from seven species of fungi and *Ula bolitophila* Loew, 1869 was first reared from one fungus species. This study revealed one new for Lithuania species of crane flies – *Ula mixta* Stary, 1983. In addition, for the first time a trophic relationship between this species of crane flies and fungi was revealed.

**Key words:** Limoniinae, Pediciidae, Trichoceridae, larvae, *Limonia*, *Metalimnobia*, *Ula*, *Trichocera*

### INTRODUCTION

Larvae of 25 species belonging to two families of Tipuloidea crane flies (Limoniidae and Pediciidae) can develop in various fungus species in the Palaearctic. Larvae of Tipulidae crane flies can be found in such a habitat as fungi only occasionally. Development of some Limoniidae and Pediciidae species can take place only in fungi, whereas larvae of other species can be found both in mouldy wood and mushrooms. Species of crane flies associated with fungi are studied in other countries comparatively well. The first papers devoted to that issue appeared in the 19<sup>th</sup> century (Stannius 1829). Lindner's (1958) publication appeared to be the first purposive study of crane flies developing in fungi. Other authors (Buxton 1960; Dely-Draskovits 1972; Trifourkis 1977; Hackman & Meinander 1979; Savchenko & Krivolutskaya 1976; Stubbs & Chandler 1978; Krivosheina *et al.* 1986; Yakovlev 1994; Ševčík 2001, 2006) compiled the list of mushroom species associated with crane fly larvae. Only larvae of the species belonging to the genera *Achyrolimonia*, *Atypophthalmus*, *Discobola*, *Limonia*, *Metalimnobia*, *Rhipidia* (Limoniidae, Limoniinae) and *Ula* (Pediciidae) develop in fungi. *Scleroprocta sororcula* (Zetterstedt, 1851), which was recorded in *Piptoporus betulinus* (Buxton 1960), usually develops on the bottom of a streamlet and the above-mentioned record of its larvae in fungi is not typical. Only two species of *Achyrolimonia* – *A. neonebulosa* (Alexander, 1924) and *A. decemmaculata* (Loew, 1873) are associated with fungi (Lindner 1958; Buxton 1960). *A. decemmaculata* was found directly in fungi, *A. neonebulosa* develops in mouldy wood. *Atypophthalmus inustus*

(Meigen, 1818) and *Rhipidia uniseriata* Schiner, 1864 only once were recorded developing in fungi (Stubbs & Chandler 1978) as they usually occur in rotten wood. Three species of *Discobola* are associated with fungi: *Discobola annulata* (Linnaeus, 1758) – a European species developing in mouldy wood and sometimes in fungi (Krivosheina *et al.* 1986); the Palearctic species – *Discobola parvispinula* (Alexander, 1947) was recorded in *Clavicornia pyxidata* once (Ševčík 2006); *Discobola margarita* Alexander, 1924 is distributed in southeastern Palaearctic and Oriental regions and develops only in mouldy wood (Krivosheina *et al.* 1986). Larvae of *Limonia* usually develop under wet leaf litter, but the species *Limonia albifrons* (Meigen, 1818), *L. flavipes* (Fabricius, 1787), *L. nubeculosa* Meigen, 1804, *L. phragmitidis* (Schrank, 1781) and *L. trivittata* (Schummel, 1829) were also found in mushrooms (Savchenko 1981; Lindner 1958; Krivosheina *et al.* 1986; Buxton 1960; Hackman & Meinander 1979). It is known that larvae of all *Metalimnobia* and *Ula* species usually develop in fungi (Lindner 1958; Buxton 1960; Hackman & Meinander 1979; Krivosheina *et al.* 1986). Larvae of *Neolimonia dumetorum* (Meigen, 1804) and *Rhipidia maculata* Meigen, 1818 develop in mouldy wood (Krivosheina *et al.* 1986), but there are a few records of their development in mushrooms as well (Dely-Draskovits 1972; Trifourkis 1977).

Larvae of crane flies developing in fungi were not purposively investigated in Lithuania earlier.

Five species of winter flies, *Trichocera annulata* Meigen, 1818, *Tr. hiemalis* (De Geer, 1760), *Tr. regelationis* (Linnaeus, 1758), *Tr. rufescens* Edwards, 1921 and *Tr. saltator* (Harris, 1776) were reported to develop in

fungi (Yakovlev 1994). Larvae of these species usually develop in rotting organic matter. *Tr. annulata* and *Tr. saltator* can develop in corpses (Krivosheina *et al.* 1986). It was proved that *Tr. annulata* feeds on muscles. However, in Lithuania larvae of this family have not been studied at all.

## MATERIAL AND METHODS

Mushrooms with larvae were collected by S. Pakalniškis (SP), P. Ivinskis (PI), J. Rimšaitė (JR), R. Sprangauskaitė (RS) and V. Stukonis (VS) in 21 administrative districts and 41 localities in May–September 1997–2008. Alytus d., env. of Vidzgirio (N 54°22'44.8" E 24°00'06.6"); Akmenė d., env. of Peiliškės (N 56°15'30.7" E 22°37'31.6"); Anykščiai d., env. of Troškūnai (N 55°34'13.6" E 24°49'55.0"); Biržai d., env. of Spalviškiai (N 56°17'19.4" E 24°56'07.5"); Joniškis d., env. of Juodeikiai (N 56°13'55.9" E 23°12'25.7"); Kaunas d., env. of Pavejuonis (N 54°59'46.5" E 23°43'46.6"), env. of Ringovė (N 55°02'59.6" E 23°31'18.1"); Kaišiadorys d., env. of Strošiūnai (N 54°48'08.6" E 24°31'23.4"); Kėdainiai d., env. of Labūnava (N 55°09'02.9" E 23°59'00.7"); Kretinga d., env. of Kalno Grikštai (N 55°51'26.9" E 21°23'59.2"); Lazdijai d., env. of Gerdašiai (N 53°56'43.6" E 23°52'50.2"); Marijampolė d., env. of Opšrūtai (N 54°36'00.5" E 23°42'17.8"), Bukta forest (N 54°26'26.0" E 23°28'19.2"); Molėtai d., env. of Šilai (N 55°03'31.7" E 25°33'31.6"); Plungė d., env. of Mikytai (N 56°07'26.6" E 21°24'32.7"); Plungė d., env. of Plateliai (N 56°07'45.5" E 21°59'45.2"); Prienai d., env. of Stanuliškės (N 54°33'09.2" E 24°24'43.2"); Radviliškis d., env. of Burūnai (N 55°31'39.3" E 23°34'07.2"); Šiauliai d., env. of Vilkuriai (N 55°51'38.6" E 23°13'19.6"); Švenčionys d., env. of Obelų Ragas (N 55°17'16.5" E 26°02'48.3"), env. of Pažeimenė (N 55°01'34.4" E 25°52'09.5"), env. of Purvynas (N 55°01'47.04" E 25°37'56.3"), env. of Žvyriai (N 55°18'51.6" E 26°30'01.3"); Tauragė d., env. of Dabrupinė (N 55°17'53.5" E 22°06'43.8"); Trakai d., env. of Čižiūnai (N 54°35'43.1" E 24°33'54.2"), env. of Velnio Duobė (N 54°36'41.9" E 24°30'55.1"), env. of Varliškės (N 54°46'39.8" E 24°52'02.6"); Ukmergė d., env. of Vaisgėliškis (N 55°17'22.9" E 24°51'28.8"); Varėna d., Čepkeliai forest (N 54°01'45.3" E 24°24'24.7"), env. of Darželiai (N 54°01'30.1" E 24°19'27.6"), env. of Dubininkas (N 54°06'03.1" E 24°16'36.8"), Puvočiai (N 54°06'45.0" E 24°18'12.7"); Vilkaviškis d., env. of Dabrovolė (N 54°28'46.0" E 22°46'48.7"), Vištytgiris forest (N 54°26'31.4" E 22°48'12.9"); Vilnius, Antavilis forest (N 54°47'01.9" E 25°25'06.1"), env. of Pilaitė (N 54°41'51.1" E 25°11'35.6"), env. of Smėlynė

(N 54°45'04.7" E 25°22'24.1"), env. of Visoriai (N 54°45'07.3" E 25°15'26.6"); Vilnius d., env. of Vaigeliškės (N 54°48'02.5" E 24°59'58.6"), env. of Dūkštos (N 54°49'36.2" E 24°57'27.8").

Methods of collecting and rearing larvae were described by Rimšaitė (1998, 2000). Adult crane flies were studied under a Zeiss SV dissecting microscope. The terminology of morphological features used in this paper generally follows that of Oosterbroek and Theowald (1991). The distribution area of crane flies given in the current article is in accordance with Oosterbroek (2010). The distribution of crane flies and winter flies in Lithuania is given according to Podėnas (unpubl.). Habitats of crane flies larvae are presented by Podėnienė (unpubl.). A total of 500 adults of crane flies and 25 adults of winter flies were reared from mushrooms during these investigations. Adults were identified by S. Podėnas. Fungi were identified by J. Rimšaitė with the assistance of habil. Dr V. Urbonas, Dr E. Kutorga in accordance with 'Fungi of Lithuania' (Gricius & Matelis 1996; Urbonas 1997a, b, 1999, 2001; Kutorga 2000) and other atlases of fungi (Mazelaitis & Urbonas 1980; Bon 1988; Sterry 1995).

Each record is given in the following order: the species name of an insect – host fungus: the number of males, number of females, locality, sampling date/emergence date and collector's name.

## RESULTS

Eight species of crane flies (*Limonia nubeculosa*, *Metalimnobia bifasciata*, *M. quadrimaculata*, *M. quadrimaculata*, *Ula bolitophila*, *U. mollissima* Haliday, 1833, *U. mixta* Stary, 1983 and *U. sylvatica* (Meigen, 1818)) and two species of winter flies (*Trichocera hiemalis* and *Tr. rufescens*) were reared from fungi during the present investigation. Specimens of *U. mixta* were found in Lithuania for the first time. Trophic relationships of this species with fungi were revealed for the first time.

### Family Limoniidae

#### *Limonia nubeculosa* Meigen, 1804

The species is common throughout Lithuania and was found in a variety of habitats. The flight period lasts from late April until early October. *L. nubeculosa* is widespread throughout the Holarctic region.

Adults were reared from *Tricholoma* sp.: 1♂, 1♀, environs of Mikytai, 27 July – September 2007, JR.

**Habitats:** coniferous forests.

The fungi in which larvae were recorded are as follows: *Phlebia merismoides*, *Paxillus involutus*,

*Lepista nebularis*, *Flammulina velutipes* (Buxton 1960; Trifourkis 1977).

### ***Metalimnobia bifasciata* (Schränk, 1781)**

This species is common throughout Lithuania and was found in a variety of habitats. The flight period lasts from May until September. *M. bifasciata* occurs in Palaearctic and Oriental regions. According to our data, it is the commonest species of crane flies developing in fungi in Lithuania.

Adults were reared from *Amanita rubescens*: 1♀, Šilai env., 18 July – 10 August 2002, JR; from *Cortinarius* sp.: 19♂, 25♀ and two specimens, Pavejuonis env., 27 July – 14 August 2000, JR; 3♂, 3♀ and 15 specimens, Vidzgiris env., 12 August – September 2000, JR; 2♀, Plateliai, 27 August – September – October 2007, JR; from *C. armillatus*: 3♂, 1♀ Čepkeliai env., 17 August–September 2000, JR; from *Lactarius* sp.: 3♂, 4♀, Kalno Grikštai env., 20 July – August 1999, JR; from *L. deterrimus*: 9♂, 5♀ Juodeikiai env., 7 July – 3 August 1998, JR; 1♂, Labūnava env., 4–30 August 2000, JR; 34 specimens, Dabrupinė env., 2 August – 20 August – September 2000, JR; 9♂, 6♀, Peiliškės env., 4 September – October 2008, JR; from *L. necator*: 3♀, Dubininkas env., 1–27 July 1998, RS; 3♂, 8♀, Opšrūtai env., 9–20 August 2000, JR; 2♂, 7♀ and one specimen, Varliškės env., 27 September – November 2000, JR; from *L. piperatus*: 1♂, Spalviškiai env., 30 June – 24 July 1998, JR; from *L. scrobiculatus*: 4♂, 1♀, Dabrupinė env., 2–23 August 2000, JR; from *L. torminosus*: 1♂, 3♀, Dūkštos env., 19 September – October 2003, JR; from *Leccinum scabrum*: three specimens, Labūnava env., 4 August – September 2000, JR; from *Polyporus squamosus*: 1♀, 2♂, env. of Verkiai, 20–27 May – 5 June 2008, JR; from *Russula delica*: 3♀, Dūkštos env., 29 July – 25–31 August 2003, JR; from *R. foetens*: 1♂, Šilai env., 18 July – 22 August 2002, 1♂ 1♀, 18 July – 10 August 2002, JR; from *Russula* sp.: 1♂, Čižiūnai env., 23 June – 24 July 1998, SP; 4♂, 2♀, Žvyriai, 8 July – August–September 1999, JR; 5♂, 4♀, Dabrovolė, 11 July – 1 August 2002, JR; 1♂, Žvyriai env., 8 July – August 1999, JR; 5♂, 2♀, Bukta forest, 11 August – 25 August – September 2000, JR; 1♂, 1♀, Peiliškės env., 4 September – October 2008, JR; from *Megacollybia platyphylla*: 6♂, 1♀ and one specimen, Vaisgėliškis env., 19 July – 14–24 August 2000, JR; from *Paxillus involutus*: 1♀, Juodeikiai env., 7–31 July 1998, JR; 1♂, 1♀ from *Piptoporus betulinus*: Spalviškiai env., 28 May – 11–16 June 1998, VS; from *Polyporus umbellatus*: 5♀ and one specimen, Pavejuonis env., 27 July – August – September 2000, JR; from *Suillus* sp.:

2♀, Troškūnai env., 15 August – 22–26 September 2000, JR; from *Agaricales* s. l.: two specimens, Vilkuriai env., 4 August – 3 September 1999, JR; 1♂ Dūkštos env., 8 June – 8 July 1998, JR; 3♂, 2♀, Opšrūtai env., 9 August – September 2000, JR.

**Habitats:** fungi with larvae were collected in successive forest habitats: broadleaved deciduous forests (24% of samples with larvae), spruce forests (20%), oak-hornbeam forests (20%), swamp and bog woodland (16%), pine forests (12%) and mixed forests (8%).

Mushrooms in which larvae were recorded include: *Morchella esculenta*, *Gyromitra infula*, *Scutiger ovinus*, *Phlebia merismoides*, *Inonotus radiatus*, *Trametes versicolor*, *Pseudotrametes gibbosa*, *Ganoderma applanatum*, *Aurantiporus fissilis*, *Polyporus squamosus*, *Scleroderma cepa*, *Cantarellus cibarius*, *Lentinus lepideus*, *Suillus luteus*, *Xerocomus subtomentosus*, *Boletus pinicola*, *Leccinum versipelle*, *L. vulpinum*, *L. scabrum*, *Tricholomopsis platyphylla*, *Russula delica*, *Lactarius necator*, *L. resimus*, *L. terminosus*, *L. vellereus*, *Boletus edulis*, *Lyophyllum loricatum*, *Russula nigricans* (Buxton 1960; Dely-Draskovits 1972; Trifourkis 1977; Hackman & Meinander 1979; Ševčik 2001, 2004; Yakovlev 1994).

### ***Metalimnobia quadrinotata* (Meigen, 1818)**

This species is common in Lithuania and was found in a variety of habitats. The flight period lasts from late April until September. *M. quadrinotata* occurs in the Palaearctic region.

Adults were reared from *Helvella crispa*: 1♂ Burūnai 3 July – 20–30 July 2000, JR.

**Habitats:** fungi with larvae were collected in spruce forest.

Fungi in which larvae were recorded are as follows: *Gyromitra infula*, *Peziza badia*, *Clavulina cinerea*, *Amanita* sp., *Russula* sp. (Lindner 1958; Buxton 1960; Hackman & Meinander 1979; Yakovlev 1994).

### ***Metalimnobia quadrimaculata* (Linnaeus, 1761)**

This species is common in Lithuania and was found in a variety of habitats. The flight period lasts from mid May until early October. *M. quadrimaculata* is known from the Holarctic region.

Adults were reared from *Pleurotus* sp.: 2♂, Purvy-nas env., 27 September – October 2007, JR; from *Polyporus squamosus*: 1♂, Verkiai env., 20–27 May – 5 June 2008, JR.

**Habitats:** fungi with larvae were collected in deciduous swamp forest and mixed forest.

Fungi in which larvae were recorded include: *Gyromitra infula*, *Fomes fomentarius*, *Thelephora terrestris*, *Pseudotrametes gibbosa*, *Phaeolus schweinitzi*, *Laetipo-*

*rus sulphureus*, *Bjerkandera adusta*, *Abortiporus bienis* (Coe 1941; Lindner 1958; Krivosheina *et al.* 1986; Yakovlev 1994; Ševčík 2001, 2006).

## Family Pediciidae

### *Ula bolitophila* Loew, 1869

This species is common in Lithuania. It was found in very different forests. The flight period lasts from May until August. *U. bolitophila* is known from the whole of the Palaearctic region.

Adults were reared from *Megacollybia platyphylla*: 1♀, Vaisgėliškis env., 19 July – 14 August 2000, JR; from *Piptoporus betulinus*: 4♂, 1♀, Spalviškiai env., 28 May – 11 June 1998, VS; from *Russula* sp.: 1♀, Juodeikiai env., 7 July – 3 August 1998, JR.

**Habitats:** fungi with larvae were collected in habitats of successive forests: mixed, broad-leaved deciduous and spruce forests.

Fungi in which larvae were recorded are as follows: *Ganoderma* sp., *Trametes* sp., *Fomes* sp., *Pleurotus* sp., *Trametes hirsuta*, *Piptoporus betulinus*, *Hericum coralloides*, *Collybia* sp., *Laetiporus sulphureus*, *Peziza micropus*, *Bjerkandera adusta*, *Polyporus brumalis*, *P. badius*, *Pleurotus pulmonarius*, *Climacocystis borealis*, *Postia caesia* (Krivosheina *et al.* 1986; Yakovlev 1994; Ševčík 2001, 2006).

### *Ula mixta* Stary, 1983

Until now this species was not known from Lithuania. *U. mixta* is known just from the West Palaearctic (Czech Republic, Finland (south), Germany, Great Britain, Norway, Romania, Slovakia and Switzerland). The existence of a trophic relationship between larvae of this species and fungi was revealed for the first time.

Adults were reared from *Lentinus lepideus*: 7♂, 11♀, two specimens, Smėlynė env., 14 September 1997, JR; from *Ramaria flava*: 5♂, 6♀, four specimens, Ringovė, 27 July – August – September 2000, JR.

**Habitats:** fungi with larvae were collected in mixed forest.

### *Ula mollissima* Haliday, 1833

This species is very rare in Lithuania (known from just three localities). It was found in deciduous forests, carst caves and forest meadows only. The flight period lasts from May until October. *U. mollissima* is widespread in the West Palaearctic.

Adults were reared from *Armillaria mellea*: 2♂, Vaigeliškės, 7 September – 19 October 1999, JR; from *Lactarius* sp.: 1♂, Kalno Grikštai env., 20 July 1999, JR; from *L. detterimus*: 1♀, Dabrupinė, 2 July – July – September 2000, JR; from *Paxillus involutus*: 4♂, 3♀,

Varliškės, 27 September – October 2000, JR; from *Polyporus squamosus*: 10♂, 11♀, Verkiai env., 20–28 May 2008, JR; from *Russula foetens*: 1♂, 1♀, Vidzgiris env., 18 July – 1–7 September 2002, JR; from *Russula* sp.: 6♂, 10♀, Vidzgiris, 12 August – September – October 2000, JR; 1♂, Peiliškės env., 4 September – October 2008, JR.

**Habitats:** fungi with larvae were collected in mixed and deciduous forests.

Mushrooms in which larvae were found include: *Bjerkandera adusta*, *Hydnum erinaceum*, *Russula nigricans*, *Inonotus hispidus*, *Meripilus giganteus*, *Leucoporus* sp., *Polyporus squamosus*, *Pholliota alnicola*, *Ph. squarrosa*, *Collybia fuscipes*, *Lyophyllum decastes*, *Amanita excelsa*, *A. aspera*, *A. rubescens*, *Armillaria mellea*, *Oudemansiella mucida*, *Scleroderma* sp., *Pytoporus betulinus*, *Hydnum repandum*, *Boletus pulverulentus*, *Leccinium verfuscipes*, *Lyophyllum decastes*, *Hypholoma fasciculare*, *Russula adusta*, *Tricholoma inamomeum*, *Polyporus badius*, *P. squamosus*, *Albatrellus ovinus*, *Pleurocybella porrigens*, *Bondarzewia montana*, *Megacollybia platyphylla*, *Grifola frondosa*, *Pleurotus pulmonarius*, *P. squamosus*, *Hydnum repandum*, *Lactarius scrobiculatus* (Riel 1921; Lindner 1958; Trifourkis 1977; Stubbs & Chandler 1978; Ševčík 2001, 2006).

### *Ula sylvatica* (Meigen, 1818)

This species is common in Lithuania. It was found in deciduous, mixed and spruce forests, shrubs, lakeshores and river banks, farmsteads. This species has two generations a year (from late spring to early summer and from late summer to early autumn). *U. sylvatica* is widespread all over the Holarctic region.

Adults were reared from *Amanita muscaria*: 20♂, 3♀, Antavilis forest, 7 September – 2–8 October 1998, JR; 2♂, 3♀, Obelų Ragas, 26 September – October 1997, PI, SP; from *Cortinarius armillatus*: 1♀, Čepkeliai, 17 August – 21 September 2000, JR; from *Gyrodon lividus*: 12♂, 9♀, Staniuliškės env., 4 September – October 1997, JR; from *Hygrophorus* sp.: 1♀, Obelų Ragas env., 26 September – October – November 1997, PI, SP; from *Hypholoma fasciculare*: 2♂, 1♀, Gerdašiai env., 11 July – 8 August 2000, JR; from *Lactarius torminosus*: 2♂, 5♀, Čepkeliai, 17 August – 12 September 2000, JR; 11♂, 9♀ Darželiai env., 28 September – October – November 1997, SP; from *L. necator*: 3♂, 3♀ Pajuodžiai env., 12 September – October 1997, SP; 5♂, 8♀, Varliškės, 27 September – November 2000, JR; from *L. detterimus*: 2♂, 3♀ and one specimen, Strošiūnai env., 9 August – September – October 2000, JR; from *Megacollybia platyphylla*: 4♂, Velnio Duobė, 8 June – 7–15 July 2002, JR; from *Paxillus involutus*:

9♂, Juodeikiai 7 July – 24–31 July 1998, JR; 2♂, 5♀, Varliškės env., 27 September – 1 November 2000, JR; from *Russula* sp.: 16♂, 8♀ Juodeikiai, 7–30 July – 3 August 1998, JR; one specimen, Čižiūnai env., 23 June – 24 July 1998, RS; 5♂, 2♀, Gerdašiai env., 11 August – 3 September 1999, JR; from *R. emetica*: 3♀ and two specimens, Darželiai env., October 1997 – 28 September 1998, RS; from *Rozites caperatus*: 2♂, 2♀, Troškūnai env., 15 August – October 2000, JR; 2♀ from *Suillus* sp., Pažeimenė, 17 September – October 1997, JR; from *Stropharia aeruginosa*: 4♂, 3♀, Strošiūnai env., 10 August – 6 September 2000, JR; from *Verpa bohemica*: 20♂, 15♀ and one specimen, Visoriai env., 6 May – 1–2 June 1998, JR; from Agaricales s. l.: 1♀, Vaigeliškės env., 3 September – October 2000, SP; 1♂, 2♀ Pilaitė env., 14 May – 8 June 1997, JR.

**Habitats:** fungi with larvae were collected in pine (29.4%), mixed (52.9%), spruce (5.9%), deciduous (5.9%) and swamp (5.9%) forests.

Mushrooms in which larvae were recorded are as follows: *Morchella elata*, *Ptychoverpa bohemica*, *Gyromitra esculenta*, *Peziza* sp., *Scutiger ovinus*, *Ramaria aurea*, *Cantharellus cibarius*, *Lentinus lepидens*, *Suillus bovinus*, *S. luteus*, *S. variegatus*, *Xerocomus subtomentosus*, *Boletus edulis*, *B. pinicola*, *Leccinum versipelle*, *L. vulpinum*, *L. holopus*, *L. scabrum*, *Paxillus involutus*, *Hygrophoropsis aurantiaca*, *Hygrophorus erubescens*, *Camarophyllus pratensis*, *Laccaria bicolor*, *L. laccata*, *Tricholoma albobrunneum*, *T. flavobrunneum*, *T. flavovirens*, *T. focale*, *T. saponaceum*, *Armillaria borealis*, *A. gallica*, *Lyophyllum connatum*, *L. decastes*, *Melanoleuca melarealis*, *M. melaleuca*, *Lyophyllum connatum*, *Panellus serotinus*, *Tricholomopsis platyphylla*, *Amanita rubescens*, *Agaricus bitorquis*, *Coprinus atramentarius*, *Psathyrella candolleana*, *P. vernalis*, *Stropharia cyanea*, *Hypholoma capnoides*, *Pholiota heteroclita*, *Ph. lenta*, *Kuehneromyces mutabilis*, *K. vernalis*, *Inocybe lacera*, *Hebeloma mesopliaceum*, *Dermocybe cinnamomea*, *D. semisanquinea*, *Cortinarius collinitus*, *C. mucosus*, *C. trivialis*, *C. brunneus*, *Lactarius flexuosus*, *L. necator*, *L. resimus*, *L. torminosus*, *L. trivialis*, *L. rufus*, *L. scrobicularius*, *L. spinosus*, *Polyporus squamosus*, *Meripilus giganteus*, *Tyromyces fissilis*, *Heteroporus biennis*, *Pseudotrampetes gibosa*, *Bjerkandera adusta*, *Auricularia mesenterica*, *Russula cyanoxantha*, *R. paludosa*, *Peziza micropus*, *Sarcodon imbricatus*, *Albatrellus ovinus*, *Hydnum repandum*, *Paxillus involutus*, *P. filamentosus*, *Lactarius deterrimus*, *Hygrophorus* sp., *Pleurotus pulmonarius*, *Polyporus squamosus*, *Postia caesia*, *Pseudohydnum gelatinosum*, *Trametes versicolor* (Buxton 1960; Yakovlev 1994; Bryce 1957; Ševčík 2001, 2006).

## Family Trichoceridae

### *Trichocera (Trichocera) hiemalis* (De Geer, 1760)

This species is common in Lithuania. It was found in shrubs, meadows, gardens, peat bogs and various types of forests, parks and cities. This species has two flight periods a year (from late February till mid-May and from mid-September till late October). *Tr. hiemalis* is widespread all over the Palaearctic region.

Adults were reared from Agaricales s. l.: 1♂, 1♀ Vištytgiris env., 16 October – November 2002, JR.

**Habitats:** fungi with larvae were collected in deciduous forest.

Fungi in which larvae were found include: *Trametes versicolor*, *Meripilus giganteus*, *Clavulinopsis vermicularis*, *Pleurotus ostreatus*, *Sarcodon imbricatus*, *Scleroderma citrinum*, *Entoloma nidorosum* (Buxton 1960; Trifourkis 1977; Hackman & Meinander 1979; Ševčík 2001).

### *Trichocera (Trichocera) rufescens* Edwards, 1921

This species is common in Lithuania. It was found in shrubs, meadows, gardens, various types of forests and cities. The flight period lasts from late September until mid-November. *Tr. hiemalis* is widespread all over the Palaearctic region and was introduced into the Holarctic region.

Adults were reared from *Tricholoma equestre*: 6♂, 5♀, Puvočiai env., 2–25 October – 3 November 1999, JR; 1♂, 3♀ and four specimens, Dubininkas env., 1 October – 11 November 1999, RS; from *Russula nigricans*: 3♂, 2♀ Puvočiai env., 2 October – 5 November 1999, JR.

**Habitats:** fungi with larvae were collected in pine forest.

Fungi in which larvae were detected are: *Hypholoma sublateritium*, *Lepiota aspera*, *Pluteus cervinus*, *Armillaria gallica*, *A. cepistipes* (Buxton 1960; Ševčík 2001, 2004).

## DISCUSSION

Separate species of crane flies use over 150 species of mushrooms as a substrate for their larvae development (Yakovlev 1994). The investigation conducted in Lithuania earlier revealed that larvae of *Ula bolitophila*, *Achyrolimonia decemmaculata* develop in fungus fruit bodies (Podėnas 1995). However, the data available in that study on other species associated with fungi (*Metalimnobia bifasciata*, *M. quadrinotata* (Meigen, 1818)) were insufficient: the study merely indicated that these species develop in various fungus species. *M. quadri-*

*maculata* was mentioned as a species developing under the bark of *Salix* sp. trees (Table 1).

During our study larvae of *Ula mixta* were reared from fungi for the first time. This species developed in *Lentinus lepideus* and in *Ramaria flava*. Another species – *Metalimnobia bifasciata* was reared for the first time from seven fungus species such as *Piptoporus betulinus*, *Lactarius deterrimus*, *L. scrobiculatus*, *Paxillus involutus*, *Megacollobia platyphylla*, *Dendropolyporus umbellatus* and *Cortinarius armillatus*. Larvae of *Ula bolitophila* were for the first time reared from *Megacollobia platyphylla*. *Ula bolitophila* prefers lignicolous fungi (Jakovlev 1994), but we reared it from *Russula* sp. also.

A new trophic substrate – fruit bodies of the fungus *Tricholoma equestre*, *Russula nigricans* was established for *Trichocera* (*Trichocera*) *rufescens*. All literature records (Ševčík 2006) as well as our original records are from soft agarics growing in autumn. The new trophic substrate – fruit bodies of the fungus *Pleurotus* sp., *Polyporus squamosus* was established for *Metalimnobia quadrimaculata*. According to literature, this limoniid species is possibly associated with *Bjerkandera adusta*, but it was also reared from other fungus species, as well as from decaying wood (Jakovlev 1994), probably due to the pupation of larvae therein after the fungus had decomposed (Ševčík 2006).

Most larvae develop in decaying fungus fruit bodies. A total of nine species of crane flies and two species of winter flies are known to develop in fungi in Lithuania (Table 1).

#### Key to crane fly larvae (Tipuloidea: Pediciidae, Limoniidae) developing in mushrooms

Larvae of crane flies which have a hemicephalic head capsule and only two spiracles on the last abdominal segment are unique among other nematoceran Diptera developing in fungi, because the latter have more than one pair of spiracles and a eucephalic head capsule. Winter flies can be distinguished from the rest fly species by four-spiracled larvae (one pair situated on the first thoracic segment and the other one on the terminal abdominal segment). Larvae of flies belonging to the families Anisopodidae, Psychodidae and Ptychopteridae are known to be similar, but they cannot be found in fungi in Lithuania.

- 1 (18). Larva with two posteriorly situated spiracles. Head capsule hemicephalic Limoniidae, Pediciidae
- 2 (5). Spiracular field with five well developed lobes with dark sclerites (Fig. 1) *Ula* (2)
- 3 (4). Dorsal sclerite oval-shaped, with straight inner

Table 1. Crane flies and winter flies developing in mushrooms in Lithuania.

Fly species	Fungus species
<i>Achyrolimonia decemmaculata</i>	<i>Daedalea quercina</i> *
<i>Limonia nubeculosa</i>	<i>Tricholoma</i> sp.
<i>Metalimnobia bifasciata</i>	<i>Amanita rubescens</i> , <i>Cortinarius</i> sp., <i>Lactarius</i> sp., <i>L. deterrimus</i> , <i>L. necator</i> , <i>L. s. piperatus</i> , <i>L. scrobiculatus</i> , <i>L. torminosus</i> , <i>Leccinum scabrum</i> , <i>Russula</i> sp., <i>Megacollobia platyphylla</i> , <i>Paxillus involutus</i> , <i>Piptoporus betulinus</i> , <i>Polyporus squamosus</i> , <i>Polyporus umbellatus</i> , <i>Suillus</i> sp., <i>Agaricales</i> s. l. Under bark of <i>Salix</i> sp.*, <i>Pleurotus</i> sp., <i>Polyporus squamosus</i>
<i>Metalimnobia quadrimaculata</i>	Various mushrooms*, <i>Helvella crispa</i>
<i>Metalimnobia quadrinotata</i>	
<i>Ula bolitophila</i>	<i>Megacollobia platyphylla</i> , <i>Polyporus adustus</i> *, <i>P. hirsutus</i> *, <i>P. pinicola</i> *, <i>P. fomentarius</i> *, <i>Piptoporus betulinus</i> , <i>Russula</i> sp.
<i>Ula mollissima</i>	<i>Russula</i> sp., <i>Lactarius</i> sp., <i>Armillaria mellea</i> , <i>Paxillus involutus</i>
<i>Ula mixta</i>	<i>Lentinus lepideus</i> , <i>Ramaria flava</i>
<i>Ula sylvatica</i>	<i>Amanita muscaria</i> , <i>Cortinarius armillatus</i> , <i>Gyrodon lividus</i> , <i>Hygrophorus</i> sp., <i>Hypholoma fasciculare</i> , <i>Lactarius deterrimus</i> , <i>L. necator</i> , <i>L. torminosus</i> , <i>Megacollobia platyphylla</i> , <i>Paxillus involutus</i> , <i>Rozites caperatus</i> , <i>Russula</i> sp., <i>Suillus</i> sp., <i>Verpa bohemica</i> , <i>Stropharia aeruginosa</i> , <i>Agaricales</i> s. l. <i>Agaricus</i> *, <i>Boletus</i> *, <i>Paxillus</i> *, <i>Cantarellus</i> *
<i>Trichocera hiemalis</i>	<i>Agaricales</i> s. l.
<i>Trichocera rufescens</i>	<i>Tricholoma equestre</i> , <i>Russula nigricans</i>

\* – by Podėnas (1995)

- margin (Fig. 1) *U. bolitophila*
- 4 (5). Dorsal sclerite wedge-shaped, with elongated inner margin (Fig. 11) *U. sylvatica*, *U. mollissima*
- 5 (2). Spiracular field with more or less reduced lobes, which are without sclerites or with pale sclerites
- 6 (11). Hypostomal bridge with 11 teeth (Fig. 2). Spiracular field without sclerites or with hairy area between spiracles (Fig. 4) *Metalimnobia* (6)
- 7 (8). Spiracular field with large hairy area situated between the spiracles (Fig. 3) *M. bifasciata*
- 8 (7). Spiracular field without any hairy area (Fig. 12).
- 9 (10). Central frontal spike of the head capsule is shorter than the lateral one (Fig. 13) *M. quadrinotata*
- 10 (9). Central frontal spike of the head capsule is longer than the lateral one *M. quadrimaculata*

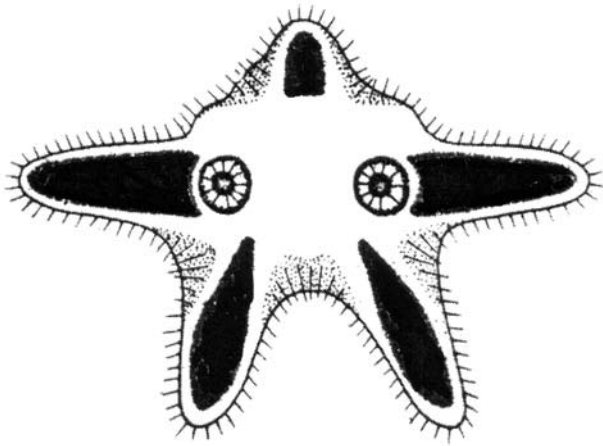


Figure 1. Spiracular field of *Ula bolitophila* (Savchenko 1986). Not to scale.

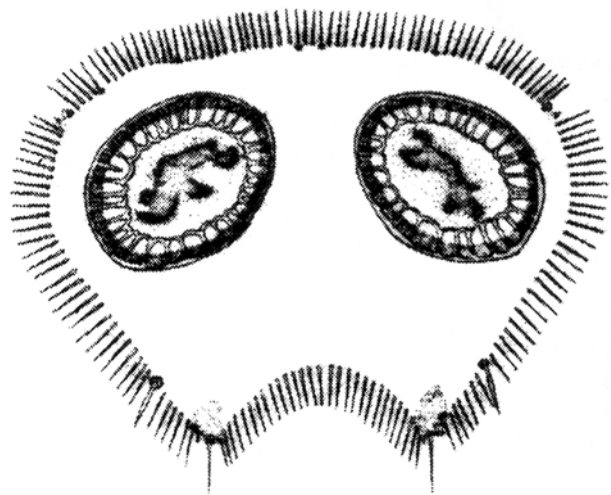


Figure 4. Spiracular field of *Metalimnobia quadrinotata* (Lindner 1958). Not to scale.

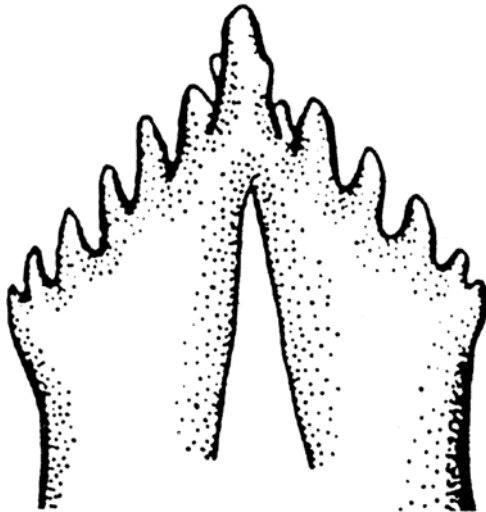


Figure 2. Hypostomal bridge of *Metalimnobia quadrimaculata* (Krivosheina & Mamaev 1967). Not to scale.

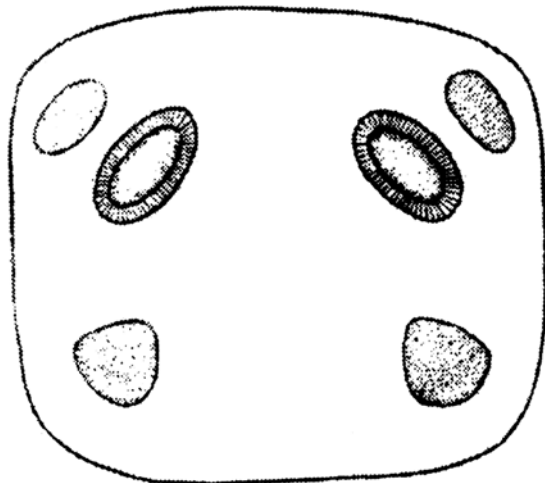


Figure 5. Spiracular field of *Achyrolimonia decemmaculata* (Savchenko 1985). Not to scale.

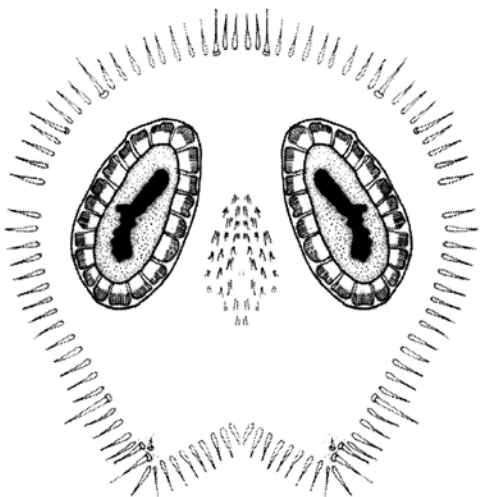


Figure 3. Spiracular field of *Metalimnobia bifasciata* (Cramer 1968). Not to scale.

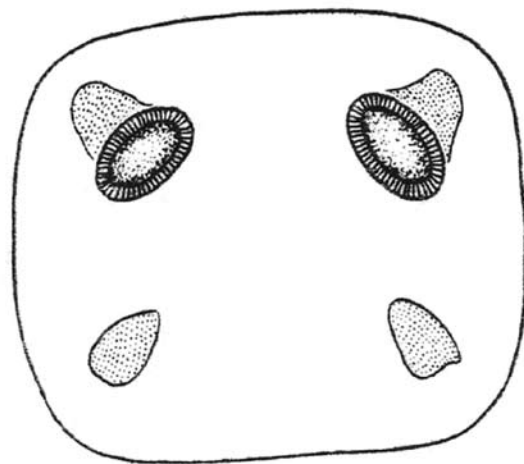


Figure 6. Spiracular field of *Limonia nubeculosa* (Brindle 1967). Not to scale.

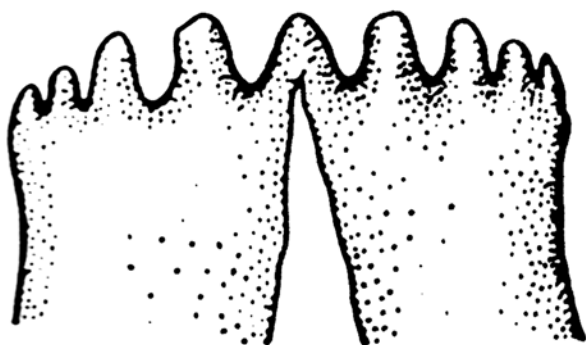


Figure 7. Hypostomal bridge of *Discobola annulata* (Krivosheina & Mamaev 1967). Not to scale.



Figure 8. Spiracular field of *Discobola annulata* (Krivosheina & Mamaev 1967). Not to scale.

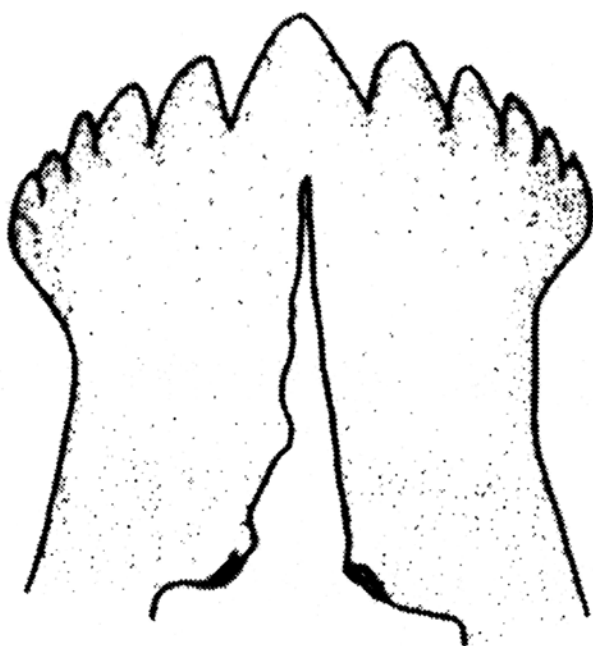


Figure 9. Hypostomal bridge of *Rhipidia (Rhipidia) maculata* (Reusch 1988). Not to scale.

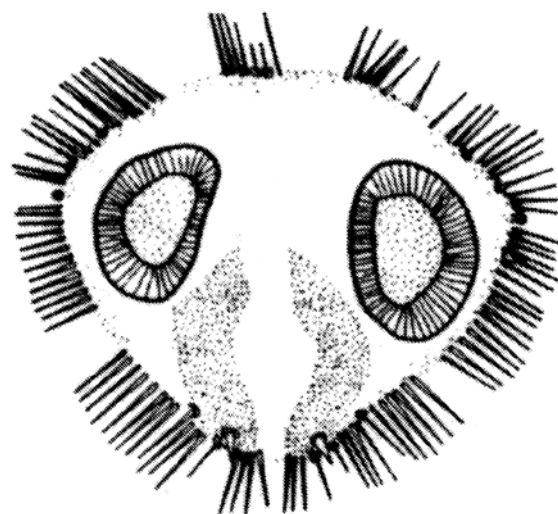


Figure 10. Spiracular field of *Rhipidia (Rhipidia) maculata* (Reusch 1988). Not to scale.

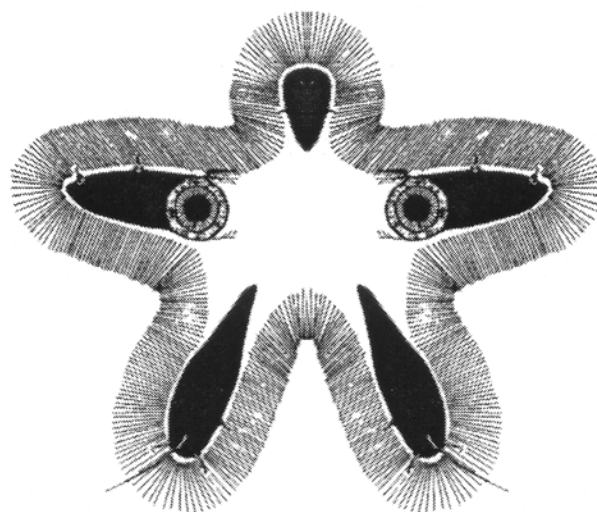


Figure 11. Spiracular field of *Ula mollissima* (Lindner 1959). Not to scale.

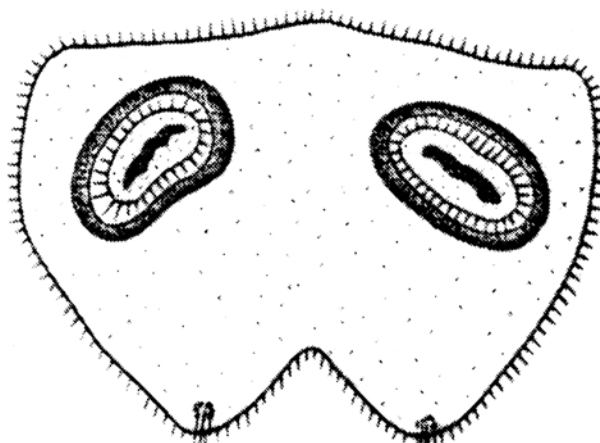


Figure 12. Spiracular field of *Metalimnobia quadrimaculata* (Savchenko 1985). Not to scale.



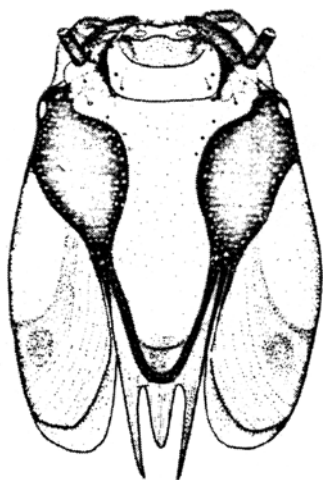


Figure 13. General view of the head capsule of *Metalimnobia quadrinotata* (dorsal view) (Lindner 1958).



Figure 14. General view of *Trichocera* sp. larva (lateral view) (Alexander 1981).

- 11 (6). Hypostomal bridge with 11 or fewer teeth. Spiracular field with two or four pale sclerites.
- 12 (15). Spiracular field with four pale sclerites.
- 13 (14). Dorsal sclerites are clearly separated from spiracles (Fig. 5) *Achyrolimonia decemmaculata*
- 14 (13). Dorsal sclerites are in contact with spiracles. *Limonia nubeculosa*
- 15 (12). Spiracular field with two pale sclerites.
- 16 (17). Hypostomal bridge with nine equal teeth, central tooth not protruded (Fig. 6). Spiracular field with two widely separated, wedge shaped sclerites (Fig. 7) *Discobola*
- 17 (16). Hypostomal bridge with 11 teeth (Fig. 8). Sclerites long, hooked and close to each other (Fig. 9) *Rhipidia*
- 18 (1). Larva with four spiracles (thoracic and posterior pairs). Head capsule eucephalic (Fig. 14) Trichoceridae.

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# LIETUVOJE GRYBUOSE BESIVYSTANTYS ILGAKOJAI IR ŽIEMINIAI UODAI (DIPTERA: LIMONIIDAE, PEDICIIDAE, TRICOCERIDAE)

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## SANTRAUKA

Pateikiamas Lietuvos ilgakojų ir žieminių uodų (Limoniinae, Pediciidae, Trichoceridae), kurių lervos vystosi grybų vaisiakūniuose, sąrašas. Pirmą kartą sudarytas Lietuvos grybų, naudojamų kaip lervų vystymosi substratas, sąrašas, bei nustatyti *Metalimnobia bifasciata* (Schrank, 1781) trofiniai ryšiai su septynių rūšių grybais, o taip pat *Ula bolitophila* Loew – vienas naujas lervų mitybinis grybas. Tyrimų metu rasta nauja Lietuvos faunai rūšis – *Ula mixta* Stary, 1983 bei pirmą kartą nustatyti šios rūšies trofiniai ryšiai su grybais.

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